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(54) Title: FRAME CONTROL METHOD AND APPARATUS

(57) Abstract

A frame control method and apparatus is described for controlling a transport frame used for transmitting a data unit via a dedicated channel between network elements of a communication system having different types of connections. The frame type coding of the transport frame is selected in accordance with a connection type of the dedicated channel, such that a connection type specific frame length, dimension and/or segmentation is achieved. This allows an efficient usage of transmission resources, wherein an overhead of control information for the transmission of the data units is minimized.

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Frame control method and apparatus

5. ## FIELD OF THE INVENTION

The present invention relates to a frame control method and
apparatus for controlling a transport frame used for
transmitting a data block via a dedicated channel between
10   network elements of a communication system having different
types of connections, such as a WCDMA (Wideband Code
Division Multiple Access) system for the UMTS (Universal
Mobile Telecommunications System).

15   ## BACKGROUND OF THE INVENTION

Third generation mobile telecommunications systems aim at
providing end-users, apart from terminal and personal
mobility, with enhanced services. Compared to second
20   generation systems, enhancements that will cover features
all the way between the end-user and the core network
elements are required, i. e. from mobile terminals to radio
access and fixed networks. The UMTS is such a third
generation system, wherein, for example, Asynchronous
25   Transfer Mode (ATM) technologies may be selected so as to
represent a business environment and support fixed ATM
terminals.

Delivering wide band multimedia services will require
30   additional performance compared with today's wireless
standards. In this respect, research has been conducted
focusing on WCDMA which fully supports both packet- and
circuit-switched communications such as Internet browsing
and land line telephone services, respectively.
35

WCDMA is based on a modern, layered network-protocol
structure similar to the protocol structure used in, for
instance, GSM networks. This will facilitate the
development of new wireless wide band multimedia
40   applications. With increasing demand for next-generation

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mobile telephone services, there will be a new set of requirements on a wireless systems, such as:

- support for high speed data communication;
- support for both packet- and circuit-switched services, such as internet traffic and video conferencing;
- higher network capacity, better usage of the frequency spectrum, each user will require more capacity compared to today's voice services;
- support for several connections.

Users will, for instance, be able to browse the Internet in parallel to voice calls and/or video conferencing.

Recently, the European Telecommunications Standards Institute (ETSI) decided on WCDMA as the radio technology for the paired bands of the UMTS. The same applies to the standardization bodies of Japan and the USA. Consequently, WCDMA is the common radio technology standard for third-generation wide-area mobile communications in Europe, North America and Asia.

The WCDMA concept is based on a totally new channel structure for all layers (L1 to L3) build on technologies such as packet-data channels and service multiplexing. The new concept also includes pilot symbols and a time-slotted structure.

In practice, certain key parameters in WCDMA and GSM have been harmonized in order to achieve an optimum solution for dual-mode GSM/UMTS terminals as well as GSM/UMTS hand-over. This will facilitate today's users easy access to third-generation services through dual-mode terminals, as will be the case with UMTS/GSM terminals.

In WCDMA systems, user plane data entities (in the following referred to as transport blocks TB) need to be transported between a radio network controller (RNC) and a

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base station (BS) of a mobile network like the GSM network.
A frame layer control protocol exists that handles the
transmission between the above two network elements (BS and
RNC), which is referred to as Radio Block Transport
5   Protocol (RBTP) in the following.

The RBTP is adapted to attach to a transport block TB all
information which the layers 2/3 in the RNC and the layer 1
in the BS need to exchange. This information is necessary
10 for synchronization (e.g. a frame number to synchronize the
transmission), outer loop PC (e.g. a frame reliability
information and a power control command), macro diversity
combining (e.g. a system frame number and the L1 cyclic
redundancy check), indication of L1 processing to be done
15 (e.g. a transport format indicator TFI), and identification
of a channel to which the present TB belongs.

According to a known solution, a fixed structure of the
RBTP frame for one kind of channel is used, e.g. there is
20 one structure for a dedicated channel with a fixed number
of bit reserved for every field.

However, the parameters necessary to be attached to the TB
are different for different kind of transport channels that
25 the WCDMA system supports (e.g. common channels, dedicated
channel with and without soft handover possibility, high
and low bit rate, fixed or variable bit rate, best effort
packet data channels), because the nature of the channels
and the characteristic of the data transmitted over them
30 are different.

Therefore, the above known solution leads to the drawback
that the transmission link is not efficiently used, since
the RBTP frame may contain information which is not
35 necessary or which can be specified with a minor number of
bits, due to the specific characteristic of the channel.

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SUMMARY OF THE INVENTION

It is therefore an object of the present invention to provide a frame control method and apparatus which allow
5   flexibility and minimum usage of the transmission link capacity.

This object is achieved by a frame control method for controlling a transport frame used for transmitting a data
10   unit via a dedicated channel between network elements of a communication system having different types of connections, comprising the steps of:
encapsulating a data unit into said transport frame; and selecting a frame type coding of said transport frame in
15   accordance with a connection type of said dedicated channel.

Additionally, this object is achieved by a frame control apparatus for controlling a transport frame used for
20   transmitting a data unit via a dedicated channel between network elements of a communication system having different types of connections, comprising:
means for encapsulating said data unit into said transport frame; and
25   means for selecting a frame type coding of said transport frame in accordance with a connection type of said dedicated channel.

Accordingly, an adaptive frame type coding is provided,
30   which allows a very efficient usage of the transmission resources between the network elements, whereby the overhead of the control information for the transmission of the user data is reduced to a minimum. Moreover, the memory required to buffer the user data in the network elements is
35   reduced. This benefit is of particular advantage in WCDMA systems, because dedicated channels with a wide range of characteristics are provided therein, and the usage of a common structure for the transport leads to a high protocol

overhead, particularly for speech channels. Nevertheless, the above solution can be used in any communication system having different types of connections.

5   In view of the fact that a minimum control information is used, processing capacity can be reduced, since the decoding processing requires less processing capacity.

      Preferably, the frame type coding defines specific control
10   information fields of the transport frame and their bit number. Thus, unnecessary control information fields which are not required for specific connection types of a dedicated channel can be canceled or at least their bit number can be reduced, so as to reduce the overhead of the
15   control information. In particular, the bit number of a transport format indicator field can be determined on the basis of the number of different transport format indicators allowed for a dedicated channel.

20   Furthermore, the value of the transport format indicator field may define if and how a whole original data unit is split into different data units to be transported via the dedicated channel. Thereby, a segmentation of a transport data block may be performed, if its dimension exceeds the
25   maximum dimension allowed by the underlying transport mechanism of the connection type of the dedicated channel.

      Moreover, the value of the transport format indicator field may define the presence and/or bit number of another one of
30   said specific control information fields. Thereby, a specific control information relating to the transport format of the connection can be added or adapted. Such a specific control information may be a frame reliability information required for high bit rate transmissions in
35   order to improve quality control.

      The coding format may be selected in a set-up phase of the dedicated channel based on corresponding set-up parameters

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of the dedicated channel. Thus, the structure of the
transport frame readily can be changed when a change of the
channel parameters of the dedicated channel has been
detected.

5

In case only one transport connection is allocated to the
dedicated channel, a channel indicator field may be deleted
from the control information, since the network elements at
the receiving and the transmitting end already know the
type of connection, such that the frame type can be decoded
at the receiving end using both the information concerning
the connection type and the short frame information code
provided in a transport frame itself.

15 The frame control method preferably may be used in a user
plane interface of a WCDMA system. The dedicated channel
may be an ATM AAL2 channel, wherein the data unit may be a
user plane data unit.

20 In case the frame control method is used in a mobile
communication system, such as the GSM system, the network
elements may comprise a base station and a radio network
controller.

25   BRIEF DESCRIPTION OF THE DRAWINGS

In the following the present invention will be described in
greater detail on the bases of a preferred embodiment with
reference to the accompanying drawings in which:

30

Fig. 1 shows a block diagram of a mobile communication
system connected to different network types in order to
deliver multimedia services,

35 Fig. 2 shows a principle diagram of a transport frame used
in the frame control method according to the present
invention, and

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Fig. 3 shows a principle block diagram of a network element comprising a frame control apparatus according to the preferred embodiment of the invention.

5   DESCRIPTION OF THE PREFERRED EMBODIMENT

The following preferred embodiment relates to a frame control method used in a WCDMA system used in a mobile communication system.

10

According to Fig. 1, a mobile communication system 6 comprises a mobile station (MS) 1 radio-connected to a base station subsystem (BSS) 2. The BSS 2 is connected to a radio network controller (RNC) 3 which may be connected to

15   a circuit-switched network like a Public Switched Telephone Network (PSTN) 4 and to a packet-switched network like the Internet 5.

The WCDMA system enables a full support of both packet- and

20   circuit-switched communications.

In the WCDMA system according to the preferred embodiment, the RBTP is used to adapt the UMTS user plane interfaces Iur and Iub between the RNC 3 and the BSS 2. In particular,

25   the RBTP is used to adapt the TB, i.e. a user plane data unit such as a MAC PDU (Media Access Control Packet Data Unit), to an AAL 2 channel (ATM Adaptation Layer type 2). In such a transmission, the type of the transport frame (RBTP frame) has to be indicated in each frame. However, in

30   at least most connection types only a small subset of the possible FCL frame types is used. The TBs (MAC PDUs) are encapsulated by the RBTP in frames that contain all the relevant information which is to be exchanged between the BSS 2 and the RNC 3.

35

Fig. 2 shows an example for such a transport frame. According to Fig. 2, the transport frame consists of transport blocks TB and a control information portion CI

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comprising a plurality of control information fields. The
control information portion CI forms the head of the
transport frame and is may be called "header" of the
transport frame. The control information field CI is
5   followed by a plurality of transport blocks TB which
correspond to the user plane data units (PDUs).

As indicated by the arrow in Fig. 2, the RBTP defines a
connection type specific frame type coding of the transport
10   frame, wherein different bit rates and different natures of
the dedicated transport channel (e.g. an AAL 2 link) are
considered. In particular, the information fields of the
control information portion CI of the transport frame and
their bit numbers are selected in accordance with the
15   connection type of the dedicated transport channel.

Fig. 3 shows a principle diagram of a downlink or uplink
part of a network element 10 such as the RNC 3 or a base
station controller BSC of the BSS 2, respectively. The
20   network element 10 is arranged at one end of a transmission
link such as the AAL2 connection. An input signal
comprising TBs to be transmitted via the AAL2 connection is
received by a receiving means 11 which extracts the TBs
from the received input signal and supplies the extracted
25   TBs to a frame generating means 12. The frame generating
means 12 encapsulates the supplied TBs in frames in
accordance with the RBTP, so as to generate the RBTP frames
to transmitted via the AAL2 connection.

30   Furthermore, a selecting means 13 is provided which
receives from the receiving means 11 an information
concerning the connection type of the dedicated transport
channel. This connection type information may be derived
from received parameters of the dedicated transport
35   channel. Based on the connection type information, the
selecting means 13 selects a specific frame type coding and
controls the frame generating means 12 so as to generate

the RBTP frames in accordance with the selected frame type coding.

The frame type coding can be selected in the set-up phase based on the parameters of the dedicated transport channel, and may be modified by the selecting means 13 when the parameters are changed. Moreover, in case different transport formats are used in the dedicated channel, the transport format currently used for a specific user plane data unit set may also specify if and how the whole user plane data unit set is split into different TBs of the RBTP. Optionally, the value of a transport format indicator (TFI) of the control information portion CI may also be used to determine the presence and bit number of other information fields in the control information portion and their bit numbers.

Thus, the frame type coding of the transport frame and particularly the length of the control information portion CI depends on the connection characteristic of the dedicated channel, in which they are used.

For example, the length in bit of a transport format indicator (TFI) field is given by the number of the different TFIs that are allowed for that channel. Moreover, as already said, the current TFI may define how a complete set of data units or transport blocks (i.e. the transport block set which is processed as a single entity by the OSI layer 1 of the BSS 2) is segmented (if necessary) into different transport frames. The segmentation of the TB may be required if its dimension exceeds the maximum dimension allowed by the underlying transport mechanism of the connecting type of the dedicated channel.

An additional frame reliability information field may be provided in the control information portion, if the TFI value indicates a high bit rate transmission via an established connection. Thereby, quality control of the

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high bit rate transmission can be improved. However, in
case the TFI value indicates a low bit rate transmission
via the same connection, such a frame reliability
information field is not provided in the control
5   information portion.

In case one transport connection, such as the AAL 2
connection, is allocated to a dedicated channel, it is not
necessary to provide a channel/sub-channel indicator in the
10   transport frames, because the transmission resources
dedicated for the specific channel are used.

In the following, examples for different dedicated channels
and their corresponding frame type codings selected by the
15   selecting means 13 are described:

A first dedicated channel DCH1 may be a speech channel with
two transport formats relating to 4.8 kbit/s and
0 kbit/s (Discontinuous Transmission, DTX). In this case,
20   each transport frame carries two transport blocks TB,
transmitted in 20 ms, or no data (speechless period), and
may be composed such that the TBs are provided with their
Cyclic Redundancy Check (CRC) information or another
reliability information. The control information portion CI
25   comprises a frame number (N bits, constant as a system
parameter), a TFI field of only one bit defining the two
transport formats, i.e. speech or no speech, and all
relevant outer loop PC information.

30   Furthermore, a second dedicated channel DCH2 may be
provided, to which a CS variable rate connection with 16
different transport formats corresponding up to 256 kbit/s
is allocated. Here, the structure of the transport frame
corresponds to that of the DCH1, wherein the TFI field is
35   composed of 4 bits the value of which determines how the
whole transport block set is segmented. For example, TFI =
16 indicates three transport frames for every transport
block set, wherein the structure of the second and third

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frame is different from the structure of the first frame. In this case, it is not necessary to specify any frame number in the second and third frame.

5   Additionally, a third dedicated channel BCH3 may be provided for a unidirectional best effort packet data connection without macro diversity. In this case, the transport frame not necessarily requires all the fields related to the outer loop PC and a macrodiversity combiner

10   in the control information portion CI. However, if a common pipe is used to transport multiple dedicated channels of this type, the control information portion CI of the transport frame must include a channel identifier.

15   As can be gathered from the above description of the preferred embodiment, the frame type coding of the transport frame, i.e. fields and bit number per field of the control information portion CI, its dimension and segmentation, is defined for each connection type of the

20   dedicated channel, and may change when the channel parameters defining the connection type are changed. Thus, this connection type specific frame type coding requires less bits then the above mentioned traditional coding method, and transmission and processing capacity can be

25   saved.

It should be understood that the above description and accompanying drawings are only intending to illustrate the present invention. Thus, the frame control method and

30   apparatus according to the present invention may also be used in other communications systems having different types of connections. The preferred embodiment of the invention may vary within the scope of the attached claims.

35   A frame control method and apparatus is described for controlling a transport frame used for transmitting a data unit via a dedicated channel between network elements of a communication system having different types of connections.

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The frame type coding of the transport frame is selected in accordance with a connection type of the dedicated channel, such that a connection type specific frame length, dimension and/or segmentation is achieved. This allows an

5   efficient usage of transmission resources, wherein an overhead of control information for the transmission of the data units is minimized.

Claims

1.   A frame control method for controlling a transport
frame used for transmitting a data unit (TB) via a
dedicated channel between network elements (2, 3; 10) of a
communication system having different types of connections,
comprising the steps of:
(a)   encapsulating said data unit (TB) into said transport
frame; and
(b)   selecting a frame type coding of said transport frame
in accordance with a connection type of said dedicated
channel.

2.   A frame control method according to claim 1, wherein
said frame type coding defines specific control information
fields of the transport frame and its bit number.

3.   A frame control method according to claim 2, wherein
said specific control information fields include a
transport format indicator field the bit number of which is
determined on the basis of the number of different
transport format indicators allowed for said dedicated
channel.

4.   A frame control method according to claim 3, wherein
the value of said transport format indicator field defines
if and how a whole original data unit set is split into
different data units to be transported via said dedicated
channel.

5.   A frame control method according to claim 3 or 4,
wherein the value of said transport format indicator field
defines the presence and/or bit number of another one of
said specific control information fields.

6.   A frame control method according to claim 5, wherein
said other one of said specific control information fields

is a frame reliability information field which is provided
when the value of said transport format indicator field
indicates a high bit rate transmission.

5   7.   A frame control method according to any one of the
preceding claims, wherein said frame type coding is
selected in a set-up phase of said dedicated channel based
on corresponding set-up parameters of said dedicated
channel.

10

8.   A frame control method according to claim 1, wherein
said frame type coding does not include a channel indicator
field, if one transport connection is allocated to said
dedicated channel.

15

9.   A frame control method according to any one of the
proceeding claims, wherein said frame control method is
used in a user plane interface of a WCDMA system.

20   10.   A frame control method according to claim 9, wherein
said dedicated channel is an AAL 2 channel and said data
unit is a user plane data unit.

11. A frame control apparatus for controlling a transport
25   frame used for transmitting a data unit (TB) via a
dedicated channel between network elements (2, 3; 10) of a
communication system having different types of connections,
comprising:
(a) means (12) for encapsulating said data unit (TB) into
30   said transport frame; and
(b) means (13) for selecting a frame type coding of said
transport frame in accordance with a connection type of
said dedicated channel.

35   12.   A frame control apparatus according to claim 1,
wherein said network elements (2, 3; 10) comprise a base
station subsystem (2) and a radio network controller (3) of
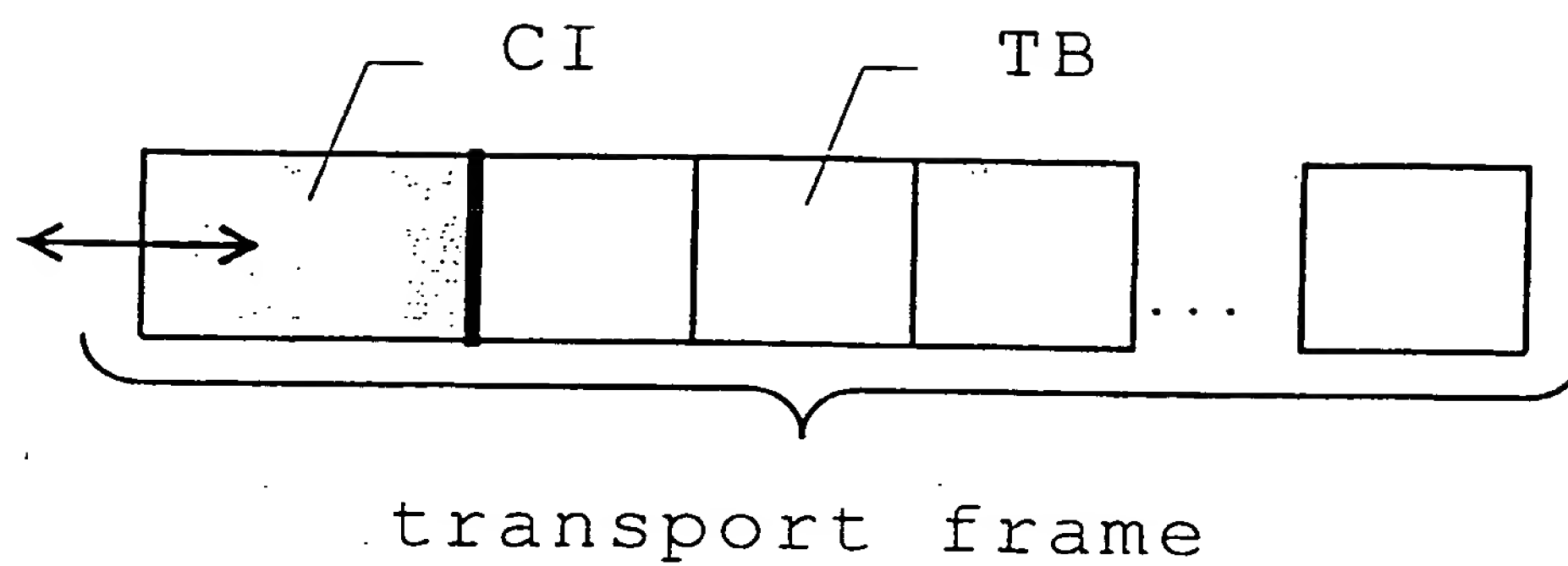a mobile communication system (6).
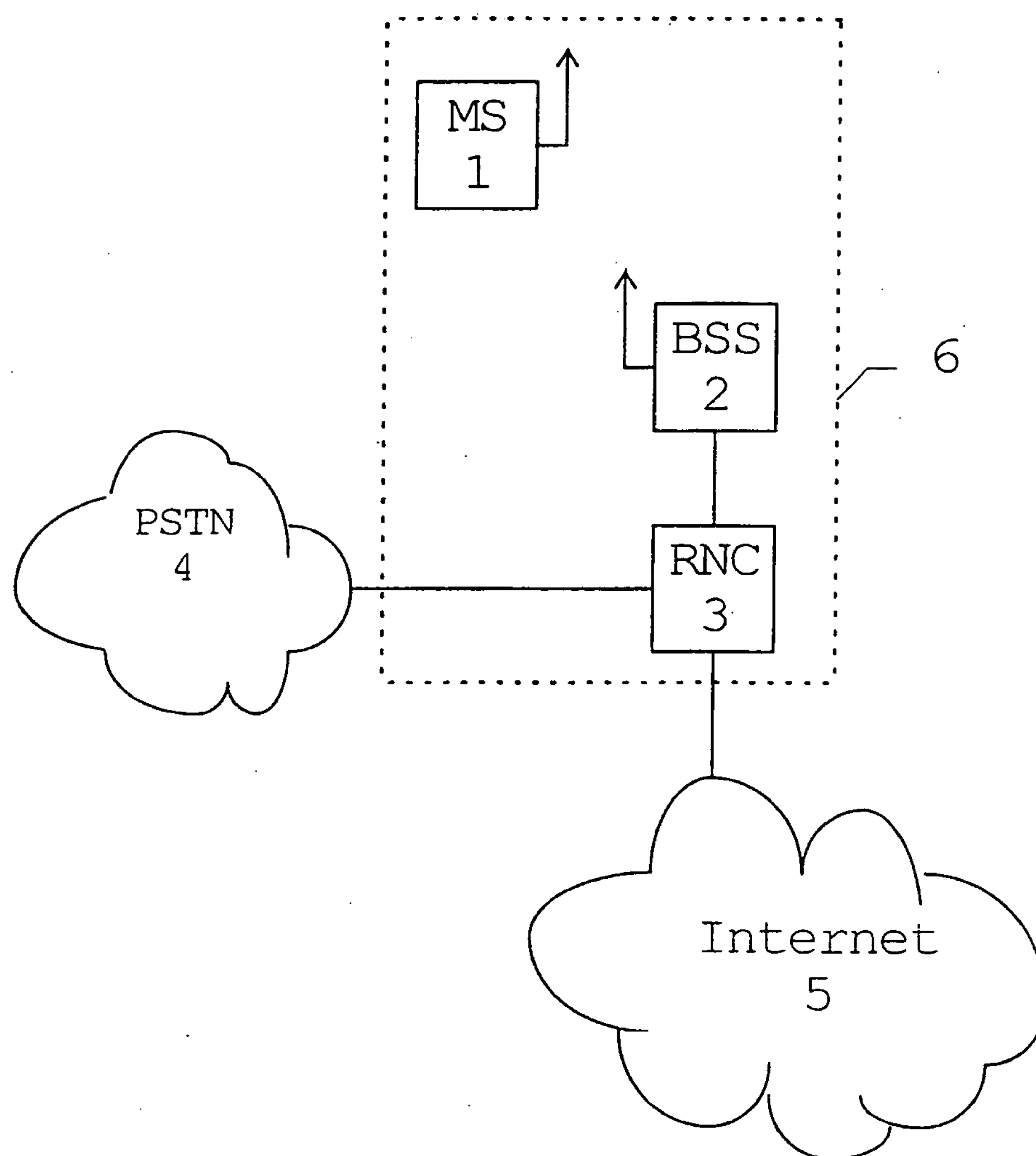
Fig. 1

Fig. 2

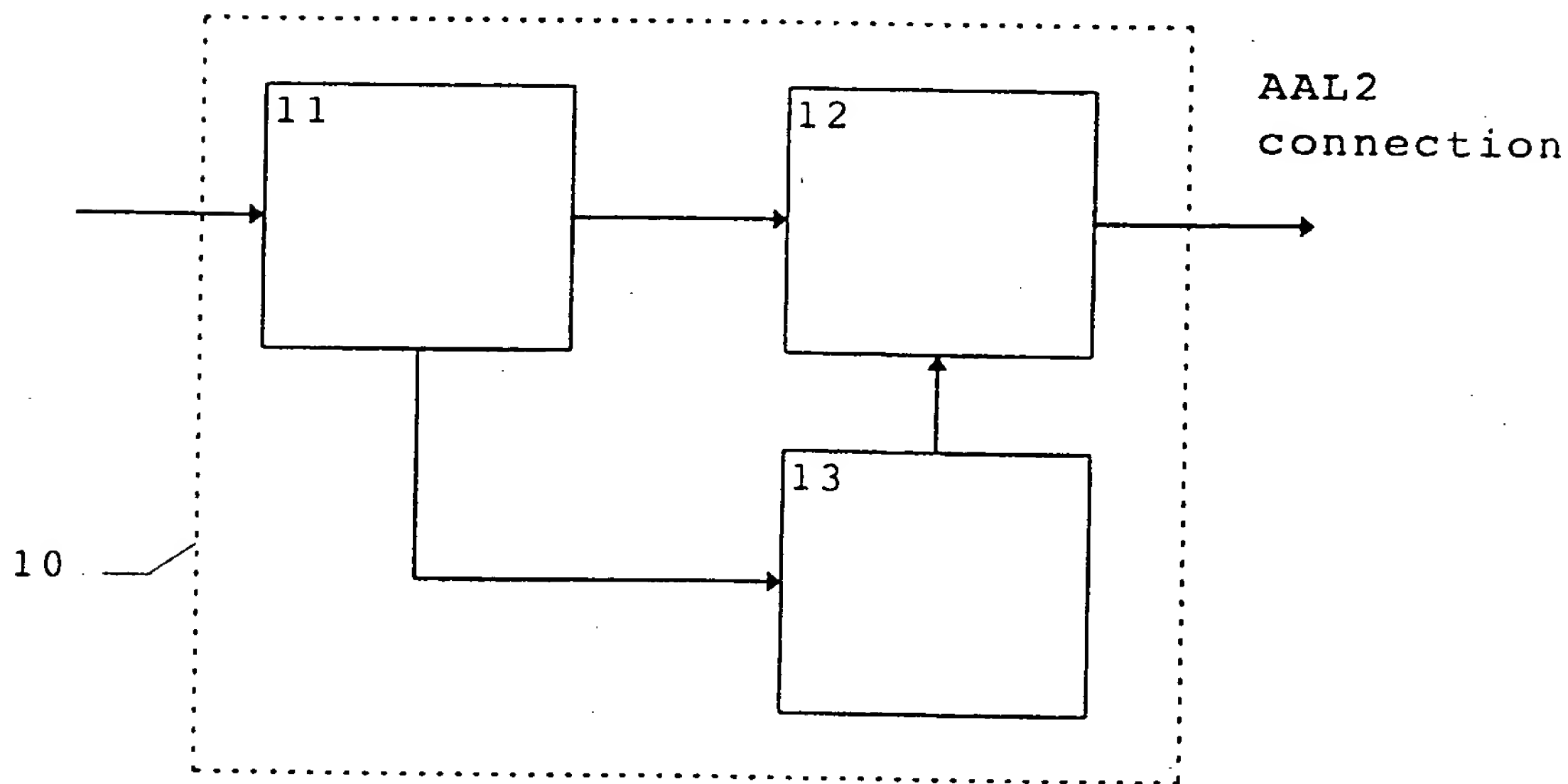**Fig. 3**

INTERNATIONAL SEARCH REPORT

A. CLASSIFICATION OF SUBJECT MATTER
IPC 6   H04L12/28   H04Q7/22   H04Q11/04

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 6   H04L   H04Q

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category°	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	BOUDEC J Y LE: "THE ASYNCHRONOUS TRANSFER MODE: A TUTORIAL" COMPUTER NETWORKS AND ISDN SYSTEMS, vol. 24, no. 4, 15 May 1992, pages 279-309, XP000264210 see paragraph 4	1,2,11
A	WO 97 16890 A (ERICSSON INC) 9 May 1997 see page 5, line 24 - page 6, line 7 see page 14, line 14 - page 15, line 4	1,2,11
A	WO 96 21983 A (NOKIA TELECOMMUNICATIONS OY) 18 July 1996 see page 16, line 16 - page 18, line 3	1,2,11

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[X] Further documents are listed in the continuation of box C.   [X] Patent family members are listed in annex.

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Date of the actual completion of the international search	Date of mailing of the international search report
2 June 1999	10/06/1999

Name and mailing address of the ISA	Authorized officer
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INTERNATIONAL SEARCH REPORT

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication,where appropriate, of the relevant passages	Relevant to claim No.
A	ENEROTH G ET AL: "ATM TRANSPORT IN CELLULAR NETWORKS" ISS '97. WORLD TELECOMMUNICATIONS CONGRESS. (INTERNATIONAL SWITCHIN SYMPOSIUM), GLOBAL NETWORK EVOLUTION: CONVERGENCE OR COLLISION? TORONTO, SEPT. 21 - 26, 1997, vol. 2, 21 September 1997, pages 139-146, XP000704463 see paragraph 5	9,10,12

1

INTERNATIONAL SEARCH REPORT

Information on patent family members

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